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# STATE OF CALIFORNIA'S COMMENTS ON THE U.S. ENVIRONMENTAL PROTECTION AGENCY'S PROPOSED REVISED RADIATION PROTECTION STANDARD FOR THE YUCCA MOUNTAIN NUCLEAR WASTE REPOSITORY

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## Background

The U.S. Environmental Protection Agency (EPA) is the federal agency responsible for setting radiation protection standards to protect public health and the environment from the proposed underground high-level radioactive waste repository at Yucca Mountain, Nevada. It has been longstanding U.S. policy to dispose of these wastes underground in a mined geologic repository.

The U.S. Department of Energy (DOE) is responsible for developing and eventually operating a high-level waste repository. The U.S. Nuclear Regulatory Commission (NRC) and EPA are responsible for regulating the high-level waste disposal program to ensure adequate protection of public health.

In 1985, EPA issued its first generic standards for managing, storing and disposing of radioactive wastes, including high-level wastes. These standards were intended to apply to any storage or disposal facility including Yucca Mountain. The standards were challenged, litigated, and ultimately reissued in December 1993 (40 CFR 191). Before EPA reissued the standard in 1993, Congress passed the Energy Policy Act (1992) which mandated a separate process for setting a standard specifically for the proposed repository at Yucca Mountain. The Act directed EPA to contract with the National Academy of Sciences (NAS) to provide the scientific basis for the standard for the Yucca Mountain Site and required the standards that EPA promulgated to be based upon and consistent with NAS' findings and recommendations on the standards.

In 1995, NAS released their report Technical Basis for Yucca Mountain Standards. The NAS report concluded that the peak risks from the repository might occur tens to hundreds of thousands of years or even farther into the future. The NAS recommended standards that would apply to the time of maximum risk and stated that there is no "scientific basis for limiting the time period of the individual-risk standard to 10,000 years or any other value."

EPA issued proposed standards for Yucca Mountain in 2001 (40 CFR Part 197) including a standard of 15 millirem per year for the first 10,000 years, after which there would be no standard. These standards included four sets of standards against which compliance would be assessed: a storage standard for when waste is received and handled at the site and emplaced in the repository and three separate waste disposal standards applying to releases of radionuclides from the disposal system after final closure. These three separate disposal standards were an individual protection standard, a human intrusion standard, and a groundwater protection standard.

The EPA 2001 proposed standards were challenged by the State of Nevada, the Natural Resources Defense Council, and the Nuclear Energy Institute. In a ruling by the U.S. Court of Appeals for the District of Columbia District in July 2004, the Court concluded that "the 10,000-year compliance period selected by EPA violates the Energy Policy Act of 1992 because it is not 'based upon and consistent with' the findings and recommendations of the National Academy of Sciences. " The Court ruled that EPA had not justified its decision to apply compliance standards only to the first 10,000 years after disposal.

In August, 2005, EPA issued its revised proposed Yucca Mountain radiation protection standard (70 Fed. Reg. 49014, August 22, 2005). The standard is designed to protect the closest residents to the repository (residents currently located at Lathrop Wells, Nevada) to a level of risk within the range considered acceptable for all other cancer-causing pollutants. The new standard proposed by EPA in 2005 is nearly identical to the previous standard adopted in 2001. The old rule established a 15 millirem/year individual protection standard for the first 10,000 years, and no limit thereafter. The new standard establishes the same 15 millirem/year standard for the first 10,000 years, and a much higher standard of 350 millirem/year thereafter. The old rule included no groundwater protection standard after 10,000 years and that remains the same for the new rule.

EPA will not consider comments on the separate groundwater standard. EPA concluded that the Court's ruling regarding the 10,000-year compliance period does not apply to the separate groundwater protection standard and that public health protection is provided by the individual-protection standard that accounts for radionuclide transport and exposure through all pathways (air, water and soil).

The proposed repository is located above an important groundwater aquifer that is currently being used for drinking, irrigation and dairy cattle. The groundwater standard that EPA originally adopted in 2001 requires that DOE meet a standard equivalent to the radionuclide "Maximum Contaminant Levels" established for drinking water. The groundwater standard is designed to protect the aquifer beneath Yucca Mountain as both a resource for current users and potential future users in the vicinity of the repository and at greater distances.

In the current repository design, the radioactive materials would be placed about 1,000 feet beneath the land surface and about 1,000 feet above the closest ground water. The repository is currently designed to hold 70,000 metric tons of waste, 90 percent of which would be spent fuel from commercial nuclear power plants and 10 percent of which would be from high-level radioactive waste from federal defense programs.

## Potential Impacts in California

The most significant potential impacts in California from the proposed Yucca Mountain high-level waste repository are: transportation impacts from spent fuel transport to the repository and potential groundwater impacts in the Death Valley region, including potential impacts on public health, wildlife, natural habitat, and public parks. Groundwater contamination and the potential migration of radionuclide contaminants in groundwater to sensitive receptors (for example, people, wildlife, and habitat) in California are major concerns.

Inyo County's representative reported (at the October 20, 2005 EPA hearing) on the results of studies jointly sponsored by Inyo, Nye and Esmeralda Counties on the possible hydrologic connectivity between the Lower Carbonate Aquifer that underlies Yucca Mountain and surface water discharges in Death Valley National Park in California. These studies indicate that the Lower Carbonate Aquifer is a source of surface waters in Death Valley National Park. These studies also indicate that the Lower Carbonate Aquifer may extend to the communities of Death Valley Junction, Shoshone and Tecopa-- all of which rely exclusively on groundwater. The long term potential groundwater contamination is the primary pathway for exposure of Inyo County residents to radioactive contamination from the Yucca site.

## Comments on the Proposed Standards

1. **EPA's radiation protection standard should be consistent with the NAS findings and recommendations. Therefore, a radiation exposure limit should be set within the recommended range of 10 millirem/year to 30 millirem/year and include the time period when the projected maximum releases of radioactive materials from the repository are expected to occur.**

Congress in 1992 instructed EPA to prepare a standard based upon and consistent with National Academies of Sciences' (NAS) recommendations. In 1995, the NAS Committee said they "see no valid justification for a 10,000 year compliance cut-off and recommended that compliance with the standard be measured at the time of the peak risk, whenever that occurs. NAS said there is no "scientific basis for limiting the time period of the individual-risk standard to 10,000 years or any other value."

The maximum release of radioactive contaminants to the environment, based on DOE models, is predicted to occur in the tens to hundreds of thousands of years (i.e., well beyond 10,000 years). It makes no sense to establish a more stringent standard for the period up to 10,000 years, only to relax this standard (i.e., increase it to 350 millirems per year as EPA proposes) in the following years when maximum releases from the repository to the environment are expected to occur.

If the 15-millirems-per-year standard is acceptable for the first 10,000 years, why not extend this standard beyond 10,000 years when the peak dose is expected to occur?

The NAS 1995 report referred to the principle of "intergenerational equity", which states that the risks to future generations should be no greater than the risks that would be accepted today. We recommend that EPA adopt this principle of "intergenerational equity", by establishing a radiation protection standard that applies uniformly over time and subsequent generations, i.e., would not increase from15 to 350 millirems per year after 10,000 years, as EPA proposes in their revised standards. EPA in its prior 2001 standard explained the "fundamental principle of intergenerational equity" by stating that "we should not knowingly impose burdens on future generations we ourselves are not willing to assume." 66 Fed. Reg. at 32107. EPA does not explain how the proposed rule, which imposes higher risks on future generations by raising the limit from15 millirems per year to 350 millirems per year, is consistent with this principle.

The NAS study in 1995 noted that a general consensus exists among national and international bodies on a framework for protecting the public health. This consensus opinion provides for a total radiation dose limit of 100 millirems per year from all anthropogenic sources other than medical exposures. The NAS study further concluded that a general consensus also appears to exist among national authorities in various countries to accept and use the principle of apportioning this total radiation dose limit among the respective anthropogenic sources of exposure, typically allocating to high-level waste disposal a range of 10 to 30 millirems per year. Therefore, it is reasonable that an acceptable limit for the repository should be in the range of 10-30 millirems per year, such as the 15 millirems per year proposed by EPA for the first 10,000 years of the repository operation, and that this standard should remain in effect throughout the period of maximum risk to the environment from the repository.

Radioactive waste and its hazards persist for extraordinary long time spans. The NAS recommended that the radiation protection standard should be designed to protect public health and the environment when risks posed by leaks from the repository are greatest, which they concluded might occur tens of thousands to even hundreds of thousands of years in the future after the repository is sealed. For example, iodine-129, one of the radionuclides of concern in the high-level waste to be buried in the repository, has a half-life of 17 million years. Neptunium-237, another radionuclide in high-level waste, has a half-life of over 2 million years. Again, the more restrictive radiation protection standard, i.e., 15 milirems per year, should remain in effect beyond the 10,000 year period and should not be limited to any specific timeframe.

Maintaining a constant radiation protection standard throughout the compliance period (EPA proposes 1 million years), rather than having it increase from 15 millirems per year to 350 millirems per year after 10,000 years, as EPA currently proposes, is also consistent with the findings of the recent National Academies study on the Biological Effects of Ionizing Radiation (BEIR VII). The BEIR report concluded in June 2005 that the preponderance of information indicates that there will be some cancer risk, even at low doses, although the risk is small, from ionizing radiation exposure.

2. **If the repository is licensed, a groundwater monitoring program should be established to check the flow of potentially contaminated waters from the repository into California.**

If the repository is licensed, the State of California, Nevada, and affected local authorities should develop, in partnership with DOE and EPA, an early warning groundwater monitoring system to detect potential groundwater contamination in California. This monitoring system should be in place and operational prior to the commencement of waste storage activities at Yucca Mountain. An array of monitoring wells should be established to monitor whether the repository is in compliance with standards and to provide early warning of potential ground water contamination in California. These monitoring wells should include wells located at the periphery of the site extending into the Lower Carbonate Aquifer.

It might be postulated that potential radionuclide contamination in groundwater might be attenuated to safe levels prior to harming the public and the environment. However, this assumption is highly dependent on the modeling scenarios and parameters used by DOE. For example, the potential exists for highly radioactive material to reach Franklin Lake Playa in less than 1,000 years, according to some of DOE's own modeling scenarios. (NEED TO CHECK THIS) Therefore, it is important that a well monitoring system be established to verify these models and flow patterns and check for potential contamination.

Given the extraordinarily long time span required for the waste to be contained in order to protect public health and the environment, a long-term groundwater monitoring program should be established for tracking and evaluating groundwater flow into California and potential impacts. For example, a change in the groundwater flow regime could result in the groundwater passing through geologic formations that do not have the attenuation capabilities that might be anticipated in other areas. In addition, flow direction could change due to new water storage, groundwater pumping, climate change, or other currently unknown factors. These factors could result in a change in groundwater flow to a more westerly direction, which could have a more direct affect on California groundwater radionuclide levels than might be currently anticipated.

3. **The EPA and DOE, in partnership with California, Nevada, and affected local governments, should develop and have in place prior to waste emplacement a ground water containment, clean-up and decontamination plan in the event contamination exceeds ground water standards.**

If the repository is licensed, a ground water containment, clean-up and decontamination plan should be required before waste emplacement can begin. DOE and EPA should develop a plan and program for groundwater contamination remediation in the event of leakage from the repository to the environment. In conjunction with the monitoring system described in No. 2 above, DOE and EPA, and affected state and local governments including the State of California and Inyo County, should develop a ground water clean-up, treatment, and containment plan in the event ground water contamination exceeds federal and state drinking water standards. This plan should be developed and agreed upon before waste is emplaced in the repository to prevent potentially contaminated groundwater from reaching irrigation, drinking and wildlife water resources in California.

4. **Potential future groundwater banks in California should be identified in the vicinity of the Yucca Mountain Project and the potential impacts from repository operation on these groundwater banks should be evaluated.**

California relies heavily on groundwater banking projects to meet future water supply needs. Potential future groundwater banks in California should be identified in the vicinity of the Yucca Mountain Project and potential impacts evaluated. These groundwater banking projects could potentially affect groundwater flow at the Yucca Mountain Site, and potentially be impacted by leakage from the Yucca Mountain repository. Studies should be conducted to assess anticipated radionuclide levels that could occur in California groundwater.

5. **EPA should explain how the groundwater standard relates to the proposed EPA radiation protection standard when the likely pathway from the repository to the maximally exposed individual is by way of groundwater transport.**

The primary pathway for release of radionuclides from the disposal facility, after closure, is via groundwater transport of radionuclides into the environment. Clearly, the groundwater standard is the main driver for protecting public health and the environment especially when peak doses to the environment are expected to occur, i.e., after 10,000 years. The period for assessing compliance with the groundwater standard should be consistent with the compliance period for the individual protection standard, i.e., both standards should extend out to 1 million years. However, EPA proposes that the groundwater standard extends

only to 10,000 years, while the individual protection standard would cover 1 million years.

The Federal Register notice for the proposed standards states, "The groundwater protection standards were a subject of the Court decision, were upheld, and are not a subject of today's proposal." Additionally, it is stated "... we are not proposing to modify the ground-water protection standards, either by extending the period of compliance or in any other respect. We are not requesting, and will not consider, comments regarding any aspect of the ground-water protection standards." However, since the individual protection standard includes the groundwater pathway, the compliance period for both standards should be the same and should include the time period when maximum risk to the public and environment will occur. EPA should revise the proposed standards so that the separate groundwater standard extends out to 1 million years to be consistent with the individual protection standard and includes the period of maximum risk to the public and environment. EPA should provide a clear explanation of how they intend to make these two standards – the individual protection standard and the groundwater standard --consistent.